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VETERINARY APPLIED PHARMACOLOGY AND THERAPEUTICS

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By P. W. DAYKIN, B.Sc., M.R.C.V.S.

Head, Veterinary Research and Advisory Divisions, C. J. Hewlett & Son, Ltd., Watford ; formerly Lecturer in Medicine and Applied Pharmacology, Department of Medicine, Royal Veterinary College, University of London. External Examiner in Veterinary Materia Medica, Glasgow University, 1955–1959.

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"Fluorine Alleviators" III. Field Trials Involving Cattle

BY

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William Dick Professor of Veterinary Medicine,
University of Edinburgh

SUMMARY.—This report describes trials with fluorine alleviators involving 20 cattle grazing for 3 years on an area in which the herbage was heavily contaminated with fluorine compounds arising from an industrial undertaking. Ten of the cattle were kept as controls and 10 received the fluorine-alleviator in the form of a mixture of calcium carbonate and aluminium oxide.

During the course of the trial regular analyses of herbage for fluorine content were made; it has been established that the principle factor responsible for fluctuations in herbage contamination is variation in the factory load.

While possessing some efficacy as an alleviator calcium aluminate fell short of being a completely effective antidote.

The difficulties inherent in the translation of results of experimental trials in rats to cattle under natural grazing conditions are described and discussed.

The complete solution of the problem of industrial fluorosis in farm livestock must depend upon the reduction of the loss of fluorine compounds into the atmosphere.

Introduction

THE problem of industrial fluorosis in cattle and sheep has been the subject of a review (Boddie, 1955).

The possible methods of alleviation were then considered and the literature on fluorine antidotes was reviewed and discussed. In this review the term "fluorine alleviator" was defined as describing a substance that can be given to animals in their food with the object of reducing the absorption of fluorine compounds ingested with contaminated herbage.

In a second paper (Boddie, 1957) the results of fluorine alleviator trials involving rats were reported. Up to the time of these trials of fluorine alleviators in rats the only references to fluorine alleviators were those applicable to the short-term effects of feeding fluorine antidotes. Though it was naturally desirable that experiments should be carried out with cattle and sheep, it was felt that before launching on the larger —and much more costly—trials involving farm stock the long-term effects of feeding fluorine alleviators to small experimental animals should be studied. It was realised that results obtained in rats were not necessarily applicable to ruminants but might show whether on a long-term basis the absorption of fluorine compounds could be reduced and so expense of major trials on ruminants would be justified.

In the trials with rats 3 concentrations of sodium fluoride were used, 50 p.p.m., 100 p.p.m. and 250 p.p.m. Calcium carbonate, as 5 per cent. of feeding chalk in the diet was used as the alleviator, and was found to depress the storage of fluorine compounds in the rat skeletons. In the group of rats receiving 250 p.p.m. sodium fluoride and 5 per cent. chalk the increase in fluorine content compared to the basal group was less by 50.5 per cent. than that of the group receiving 250 p.p.m. of sodium fluoride alone.

The alleviator action in rats of equal parts of calcium carbonate and aluminium oxide ("Calcium aluminate") was compared with that of calcium carbonate alone. Calcium aluminate was found to be much more effective than calcium carbonate alone and indeed showed a very high degree of effectiveness. It was however emphasised that further confirmation of this degree of effectiveness was required. The choice of aluminum oxide was governed by the need to use a substance that would be palatable to cattle and sheep. In a trial with aluminium sulphate for another purpose it had been found that cattle will not readily take aluminium sulphate when mixed with their food unless it a very low concentration. Cattle getting no other food

than that containing 0.5 per cent. of aluminium sulphate will, through hunger, gradually accept the mixture. Cattle receiving other sources of food will not eat food containing a greater concentration than 0.2 per cent. Grazing cattle will not consume food containing 0.2 per cent. of aluminium sulphate. On the other hand cattle will consume food containing 6 per cent, or more of either calcium carbonate or aluminium oxide.

Even though there are fundamental differences between rats and cattle it was considered that a field trial with farm animals was justifiable and desirable in order to establish the possible rôle of fluorine alleviators in controlling the effects of grazing on contaminated pastures.

Following a study of all aspects of the field problem the conclusion was reached that it would be more satisfactory to carry out the trials with young cattle introduced to the contaminated pasture at the age of 6 months and kept there continuously throughout the whole period of the trial. The trial started in the autumn of 1955 and was continued for 3 years.

Plan of the Trial

The site of the trial was an area of rough grazing extending to approximately 263 acres, lying north-east of the main buildings of an industrial process generating fluorine compounds. The long axis of the area was approximately south-west to north-east, and the edge nearest to the factory was approximately half a mile from it. The area was divided along its long axis—also the axis of the prevailing wind—to provide two areas each containing approximately 131.5 acres. The division was not made in a straight line as it was desired to include an old sheep fold which could form the focal point of the trial to which each group of cattle could have access and also to divide the area so as far as possible to provide that the character of the grazing was similar and some water-logged areas could be excluded. The old sheep folds were adapted so that the cattle from each area could be driven into separate pens. These provided access to troughs under a light roof where they could be fed.

The stock chosen for the trial were 20 Highland stirks aged 6 months. The selection of this breed was governed by their relatively low cost and the fact that such animals could remain out on the grazing throughout the whole year, this being a necessary feature of the trial. The animals were divided by visual selection to give 2 groups as nearly as possible equal in size. A triple method of marking each animal was used so that positive identification of individual animals could be secured throughout the course of the trial.

The group of 10 animals receiving the alleviator in the form of equal parts of calcium carbonate and aluminium oxide in supplementary food given once a day were designated the Alleviator Group. The other group receiving supplementary food alone were designated the Control Group. Each group was allocated to one of the areas described above but after some months the groups were changed round so that any difference between the grazing qualities of the herbage and between the herbage contamination with fluorine compounds would be eliminated.

Throughout the 3 years of the trial each animal was examined at approximately 3 month intervals to determine their bodily condition, general health and dental development.

Herbage Contamination

Three stations for herbage sampling were established, in each area. From each of these stations 26 samples of herbage were taken during the period of the trial; these were analysed for their fluorine content. At the same time other data in relation to weather conditions and factory output were collected in order that an assessment might be made of the factors governing fluctuations in herbage contamination. There were very considerable fluctuations in the herbage contamination but except for the period May to September, 1956, the mean did not fall below 40 parts per million and for 4 months in 1957 the mean was consistently above 80 parts per million. Even in the period May to September, 1956, the mean did not fall below 20 parts per million. It was thus established that substantial contamination of the herbage in the grazing area took place throughout the period of the trial. The fluctuations at each of the 6 sampling stations followed a common pattern and there was a correlation between the distance of the sample station from the factory and the herbage contamination.

Study of the factors governing herbage contamination showed that the only factor influencing variations in contamination was the load at the factory.

Contrary to expectations, despite the heavy rainfall in the area concerned it proved impossible to establish any correlation between rainfall and contamination. The period of lowest herbage contamination in June, 1956, coincided with a period of low rainfall, and the period of highest herbage contamination in September, 1957, also coincided with a period of scanty rainfall.

Though the prevailing winds were from the south-west, winds from the north and north-east were by no means uncommon. It was found quite impossible to establish any correlation between direction, force and prevalence of wind and herbage contamination. This observation may well not be valid for other areas, but in the area concerned a large mountain massif plays a big part in producing eddies over the grazing area regardless of the direction of the wind.

No correlation could be established between herbage contamination and either time of year or rate of herbage growth. The mean herbage contamination of the two areas showed that one area had consistently a slightly higher mean than the other.

Narrative of Trial

The provision of supplementary feeding served two purposes, one to maintain the condition of the cattle and second as a vehicle for the alleviator. The supplementary food given to each animal at the rate of 2 lb. a day consisted of:—

112 lb. of home grown bruised oats.

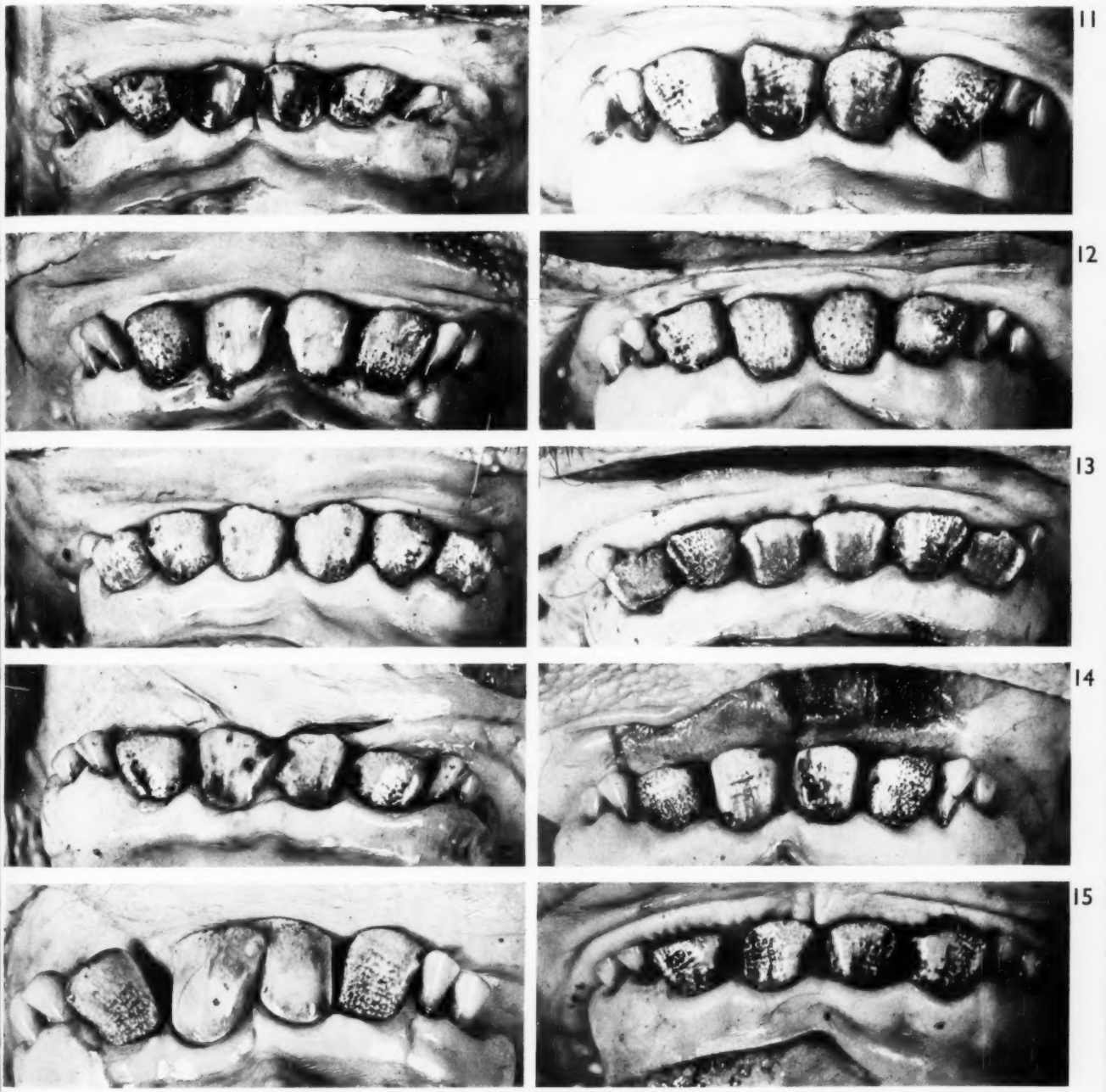

PLATE I
INCISOR TEETH
Nos. 1-5, Alleviator Group
Nos. 11-15, Control Group

PLATE I
INCISOR TEETH
Nos. 6-10, Alleviator Group
Nos. 16-20, Control Group

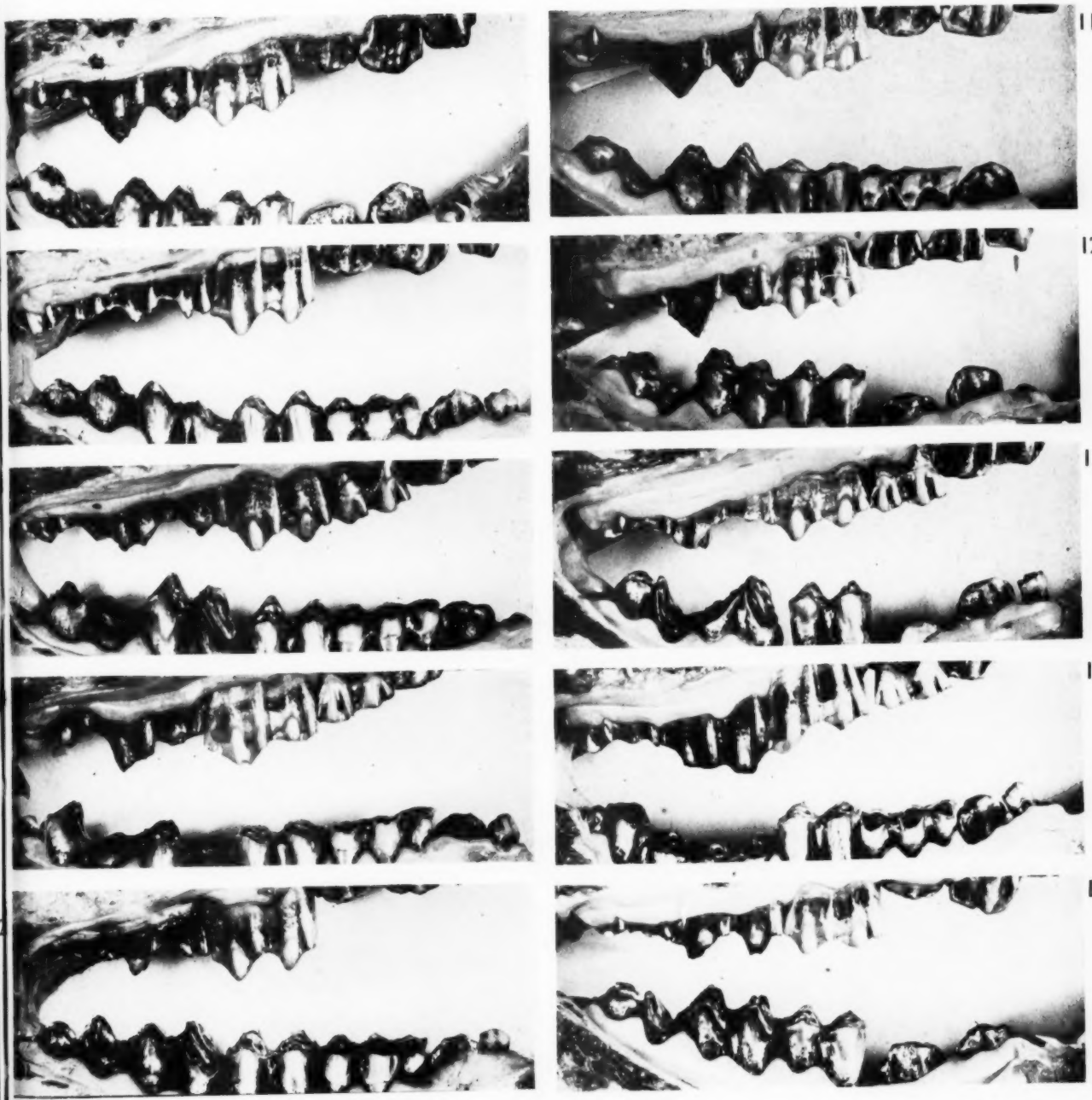

PLATE II
CHEEK TEETH
Nos. 1-5, Alleviator Group
Nos. 11-15, Control Group

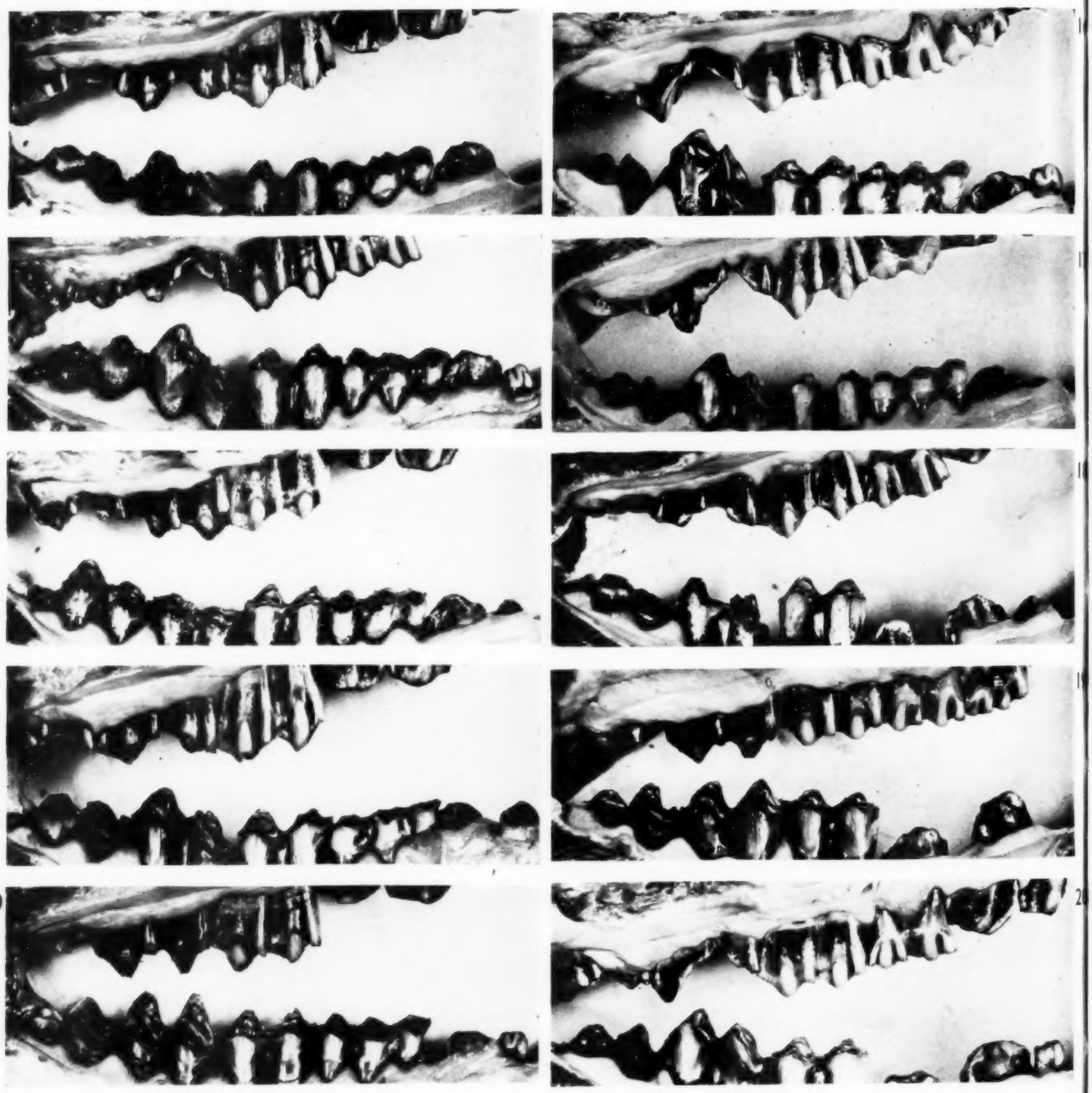

PLATE II
CHEEK TEETH
Nos. 6-10, Alleviator Group
Nos. 16-20, Control Group

6 lb. of white fish meal.
1 lb. of a proprietary mineral mixture.

The mineral mixture was stated to contain:—

Calcium	17.4 per cent.
Phosphorus	11.4 per cent.
Copper	1,800 p.p.m.
Cobalt	300 p.p.m.
Manganese	510 p.p.m.
Iodine	0.025 per cent.
Sulphur	0.75 per cent.
Iron	0.24 per cent.
Sodium chloride ...	30 per cent.

At the outset of the trial in November, 1955, the amount of calcium aluminate added to the supplementary food of the alleviator group was such that each animal received a daily dose of 1 oz. After 2 months when it was found the animals were consuming the food and alleviator readily the quantity was increased to 1½ oz. per day. Two months later the quantity was increased to 2 oz. per day and this quantity was maintained for the rest of the trial.

The critical period for the animals was the month of March, 1956, at the end of their first winter on the ground. Fortunately the weather in March was good and there was quite a fair growth of grass and by the middle of May all animals were in a thriving condition. No difficulties were experienced in the winters 1956/57 and 1957/58.

The final inspection of the living animals and their teeth was made in October, 1958. The general impression formed by this inspection was that the alleviator group were in slghtly better bodily condition than the control group and that there had been an appreciable retardation in the severity of the lesions of dental fluorosis in the alleviator group as compared with the control group. The animals were then slaughtered and tissues collected for further study and analyses.

The average live-weight of the animals in the alleviator group was 854 lb. (range of 756 to 952 lb.). The killing out percentage was 55.4 per cent. The average live-weight of the animals in the control group was 848.4 lb. (range of 700 to 924 lb.). The killing out percentage was 53.8 per cent.

Details of the Teeth

The incisor and cheek teeth were photographed within a few hours of slaughter and a composite reproduction of these photographs is shown in plates I and II. No discrepancies were revealed between the clinical examination of the teeth in life and the *post-mortem* examination of the teeth.

Two points require mention before considering the state of the teeth. The eruption of the permanent teeth took place much more slowly than is indicated in the conventional dentition tables for cattle. This is due to two factors: the breed selected are notoriously slow to develop and mature, and the plane of nutrition in which these animals were kept during the winter was obviously a low one. In several of the mouths a step can be seen at the meeting point of the pre-molars and molars. This is due to the first molar coming into wear many months before the pre-molars; thus the first molar is in full wear, while the pre-molars are only coming into wear. This point can be seen in the photographs of animals 2, 5, 8, 9, 10, 11, 12 and 15. This step between molar and pre-molar must be differentiated from the effect of selective abrasion arising from the poor-wearing qualities of teeth affected with fluorosis.

Dental fluorosis of quite a severe degree was present in all the control group except No. 19 in which, although the incisor teeth showed characteristic lesions, the cheek teeth showed less evidence than in other animals of the group.

In the alleviator group Nos. 1 and 7 showed lesions of dental fluorosis approximating those seen in the animals of the control group. In animals Nos. 3, 4, 5, 6, 8 and 9 the lesions of dental fluorosis were of a minor character. In animal No. 2 there was only very slight evidence of dental fluorosis, while in No. 10 the lesions were almost absent. In order to check the validity of these observations, the teeth were graded in two ways (1) according to the quality of the enamel of the incisor teeth and evidence of pitting, mottling and wear, and (2) according to the evidence of selective abrasion and wear of the cheek teeth. There was a substantial measure of agreement between these 2 gradings and the findings based on a general study of the mouths. Thus animal Nos. 1 and 7 mentioned already were picked up in each of the gradings and were the only two animals of the alleviator group graded down among the control group. No. 19 of the control group mentioned as showing lesser lesions than its fellows was graded among the alleviator group.

Tissue Analyses

The mean fluorine content of the left lower jaw bones of the animals in the alleviator group was 4853.3 p.p.m. (range 4342 to 5502). The corresponding mean in the control group was 4386.5 (range 3925 to 4882). The mean of the alleviator group thus was 466.8 greater than that of the control group.

The mean fluorine content of the right metacarpal bones of the animals in the alleviator group was 4820 p.p.m. (range 3892 to 5334). The corresponding mean of the control group was 4355.8 (range 3537 to 4918). The mean of the alleviator group was thus 464.2 greater than that of the control group.

The mean fluorine content of the right central incisors of the alleviator group was 3375 p.p.m. (range 2725 to 4080). The corresponding mean in the control group was 3680 (range 2800 to 4125). The mean of the alleviator group was thus 305 less than that of the control group.

Discussion

On the basis of a clinical examination of both incisor and cheek teeth it can be deduced that in 8 out of 10 of the animals in the alleviator group there had been an appreciable effect in reducing the severity of the lesions of dental fluorosis, but in only one animal did the alleviator effect nearly approach complete protection.

Analyses of the teeth showed that the mean fluorine content for the alleviator group was appreciably lower than the control group, but the figures for the bone

showed that the mean fluorine content for the alleviator group was appreciably higher than for the control group.

This discrepancy might be explained by the right central incisor used for analysis being one of the pair of incisors which are the first to be formed, erupt and come into wear. The formation and eruption occupies a period of only a few months. The clinical conditions of all the teeth and the analyses of the right central incisors indicate that in the alleviator group there had been some retardation of absorption of fluorine compounds during the time the teeth were being formed. This retardation of absorption was insufficient completely to prevent dental fluorosis but had the action of minimising the severity of the lesions.

The fluorine analyses of bones showed that the animals of the alleviator group had stored up a somewhat greater quantity of fluorine in their bones than the control group. The fluorine content of the bone represents the cumulative effect of 3 years ingestion of fluorine contaminated herbage. If the alleviator had produced a complete or nearly complete interference with the absorption of fluorine compounds it would have been reflected in the fluorine content of bone and the figures would then have shown that the bones of the alleviator group were less than those of the control group. If, however, the alleviator only retards the absorption of fluorine compounds its action may be reflected in a tissue that is formed over a relatively short period of time, but a tissue that continues to store fluorine compounds will reflect the cumulative effect of the aggregate absorption of fluorine compounds over the whole period of observation.

The teeth of the alleviator group showed less marked lesions of dental fluorosis and had a lower mean fluorine content than those of the control group, whereas the bones of the alleviator group showed a higher mean fluorine content than those of the control group. It may be significant that during the later months of the trial the alleviator group had been grazing on the more heavily contaminated of the two areas.

The difference in means in regard to the teeth is 305 p.p.m. of fluorine in favour of the allevjator group. The average difference in means in regard to the bones is 465 p.p.m. in favour of the control group. That is to say, there is a difference between teeth and bones expressed as a mean of 770 p.p.m. The difference is explained by the lower figure in relation to teeth, the storage period of which is short, and the higher figure in relation to bone, the storage period of which extended throughout the whole period of the trial.

From this experiment it was clear that the mixture of aluminium oxide and calcium carbonate only retarded the absorption of fluorine compounds and fell far short of completely preventing it. In other words, the term fluorine alleviator has been proved to be a more correct description than fluorine antidote.

The trials with rats (Boddie, 1957) gave a general indication of the possibility of using fluorine alleviators in cattle and sheep but it was realised that results in rats are not necessarily applicable to ruminants. The results in this field trial of fluorine alleviators in cattle were much less successful than those obtained in the earlier trials in rats. There are two fundamental points that must be kept in mind when considering the transition of experimental work from rats to cattle or sheep. First, there is the species difference and all that implies including the physiological difference between the rat, an animal with a simple stomach, on the one hand, and on the other hand, cattle and sheep which are ruminants. Second, there is the experimental difference that the alleviator could be and was mixed with the rats' food whereas to cattle or sheep it could only be mixed with supplementary food given once or at the most twice a day to animals that were gathering their food throughout the day while grazing on contaminated pastures.

Hobbs, Moorman, Griffith, West Merriman, Hausard, Chamberlain, MacIntyre, Hardin and Jones (1954) described experimental trials with fluorine alleviators. The major part of their work was concerned with the use of aluminium sulphate as an alleviator. Ten paired groups of cattle were set up, in each paired group 3 animals received a ration to which sodium fluoride had been added at a rate according to the group of 8, 28, 38 and 48 p.p.m., the other 3 animals received a ration to which there was added sodium fluoride at the rate described and aluminium sulphate in all groups to the extent of 0.5 per cent. The animals were kept on this regime for approximately 38 months.

Fluorine storage in bone was estimated by analysis of a portion of a rib resected from each animal. Aluminium sulphate reduced the storage of fluoride by 20.6 per cent. in the group receiving 28 p.p.m. of sodium fluoride; for the groups receiving 38, 48 and 58 per cent. of fluoride analysis showed a reduction of bone storage by 35.7, 41.7 and 37.6 per cent. respectively.

The animals when admitted to trial were from 17 to 22 months of age. As might be expected the central incisors of the control group showed but little evidence of dental fluorosis and the severity of the evidence increased from the first to the fourth incisors. The alleviator did not prevent the appearance of lesions of dental fluorosis in any of the groups, but it is stated that " close study shows that the alleviator did decrease the teeth effects." No details are given of the cheek teeth and no analyses were made of teeth from either the control or alleviator groups. On the basis of these subjective observations of the incisor teeth the action of aluminium sulphate as a fluorine alleviator appears to have been very comparable to that obtained with calcium aluminate in the trial described in this report. On the other hand the storage of fluorine compounds in bone was depressed by the action of aluminium sulphate, a result not achieved with calcium aluminate. The quantities of aluminium sulphate and calcium aluminate fed daily to the animals in the two trials were comparable.

It will be seen that the results obtained with calcium aluminate in rats were in closer approximation to

those obtained by Hobbs *et alii* with aluminium sulphate in cattle than those obtained in the present trial with calcium aluminate in cattle. In the case of the trial with rats and the cattle trials with aluminium sulphate, sodium fluoride and the alleviator were mixed with the food and every mouthful of food consumed by either the rats or the cattle contained both sodium fluoride and the particular alleviator on trial. It would therefore appear that the results obtained with rats are at least in a considerable measure applicable to cattle. It would appear that the species difference is less important than the experimental difference between feeding fluoride and alleviator in all the food and the addition of alleviator to the diet of animals ingesting food already contaminated with fluoride.

Hobbs *et alii* make no mention of adding aluminium sulphate as an alleviator to harvested foodstuffs contaminated during growth with fluorine compounds emanating from industrial undertakings. It is therefere impossible to say whether their experimental work with aluminum sulphate would be repeated under naturally occurring conditions. However Hobbs *et alii* state that it was found that "heifers (placed on pasture) getting the concentrate containing aluminium sulphate would not consume sufficient quantities to justify their continued feeding" and "when aluminium was added to the concentrates (at the rate of 0.5 and 0.2 per cent.) used to start cows on pasture, it was unpalatable and resulted in very little consumption. This phase on pasture was discontinued."

It will thus be seen that Hobbs *et alii* were unable to apply their regime of using aluminium sulphate as an alleviator to grazing cattle. In any case in order to give sufficient aluminium sulphate at concentrations of either 0.5 or 0.2 per cent. would entail the consumption of quantities of food that would be quite uneconomic to provide for grazing animals.

There remains for consideration the question as to whether an increase in the amount of alleviator fed daily would enhance the alleviator effect. Provision of the alleviator once daily may well produce conditions in the rumen whereby the concentration of alleviator diminishes towards the later part of the 24-hour period to a point where it is insufficient unless the quantity given once daily is increased or the frequency of administration is increased. To increase the amount of alleviator ingested daily would obviously entail a proportionate increase in the supplementary feeding. It must be appreciated that to increase the quantity of supplementary feeding to cattle going on rough grazing might be quite uneconomic. If to increase the intake of alleviator it was found necessary to feed the animals twice or thrice daily the labour costs would be quite prohibitive. It seems therefore that the prospects of increasing the intake of fluorine alleviator are not likely to be economically applicable to rough grazing of the type available in this trial.

Conclusions

It is clear that fluorine alleviators do not, and probably cannot be expected to, prevent the occurrence of lesions of dental fluorosis in young cattle dependent on grazing herbage contaminated to the extent revealed in this trial. Possibly fluorine alleviators might prove useful in an area where the fluorine contamination of herbage was substantially less than that prevailing in the area described, though it must be admitted the need for a fluorine alleviator would be correspondingly less urgent.

It seems therefore that the search for a solution of the problem of industrial fluorosis in farm livestock must be directed towards reducing the loss of fluorine compounds into the atmosphere.

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Spontaneous Emasculation of an Equine Cryptorchid

BY

G. H. ARTHUR and W. D. TAVERNOR

Royal Veterinary College, North Mimms, Near Hatfield, Herts.

Case Report

Subject: A 3-year-old Hack, weighing 9 cwt., bred and reared by the present owner.

History: The colt had been presented for castration as a yearling in April, 1957, when a normal testicle was removed without difficulty from the right side, but the left testicle could not be palpated and no incision was made into the left inguinal region. At this time the colt was rather undersized and it was hoped that with further growth and maturity the left testicle would descend. This did not occur, however, and in December, 1959, the animal was admitted to the Royal Veterinary College Field Station for cyptorchidectomy, with a reputation of being rather wicked but not troublesome with mares.

Examination: The horse was of normal development and in good condition. Nothing of significance could be palpated in the left inguinal region.

Operation: A dose of 500 mg. of trimeprazine tartrate was given intravenously as a sedative and then, 30 minutes later, chloral hydrate (43 gm.) intravenously until the horse became recumbent. The animal was placed in dorsal recumbency and prepared as usual for cryptorchidectomy.

The right inguinal region was inspected and the scar of the previous castration identified. The skin was incised, the spermatic cord isolated and a 2 in. length of it excised.

No scar was visible on the left side. Following the skin incision and blunt dissection into the inguinal canal, a small processus vaginalis was identified and isolated; it was incised and seen to contain a poorly developed epididymis, with the gubernaculum running from the tail of the epididymis to the fundus of the processus vaginalis. Steady traction on the epididymis failed to bring the testicle to view; one, and

then two, fingers were used to dilate the internal inguinal ring and further traction applied but still the testicle was not forthcoming. On reviewing the situation at this stage, one was perplexed by the fact that the body of the epididymis tapered anteriorly to become lost in the mesorchium. Normally, of course, it should lead on to the head of the epididymis and testicle.

Rather than pass the whole hand into the abdomen from the inguinal canal for further exploration, it was decided to continue by flank laparotomy. The gubernaculum was therefore divided so as to free the epididymis for its subsequent withdrawal into the abdomen.

At this point, following the intravenous injection of 2.75 gm. thiopentone, the horse was intubated and anaesthesia maintained by fluothane and oxygen in a closed circuit.

A 5 in. incision was made vertically into the left flank with its lowest point just anterior to the fold of the flank. A hand was introduced and passed to the left internal inguinal ring where the freed epididymis was drawn up from the inguinal canal and the vas deferens was traced backwards to the neck of the bladder. On tracing the attachments of the epididymis away from the vas deferens, the hand passed to the dorsal abdomen behind the left kidney. No testicle could be palpated. On anatomical grounds the case was inexplicable; the only valid suggestions, admittedly rather inept, which could be advanced were either congenital aplasia of the left testicle, or extreme hypoplasia of the organ. At this unsatisfactory stage in the operation, a final search of the abdomen was made and it was then surprising to find a free discoid body at the pelvic inlet. This was withdrawn, and although mummified, a distinct resemblance to testicle was at once apparent. The originally found portion of epididymis was now amputated and the laparotomy wound repaired.

The horse showed no post-operative malaise and first intention healing occurred (Fig. 1).

Description of tissues removed at Operation

In left Inguinal Canal:
1. Fundus of vaginal sac containing posterior extremity of gubernaculum.
2. Mesorchium, containing atrophied spermatic artery and veins, and vas deferens; anterior extremity of gubernaculum, tail and body of epididymis.

In Abdomen:
3. Mummified testicle, with "cystic" interior, measuring 7.5 by 6.0 by 2.0 cm., attached to which was the remains of the head of epididymis and spermatic artery.

Discussion

The most likely explanation for the necrosis of the left testicle was that it followed torsion and strangulation of the vessels of the spermatic cord. The original cystic condition of the gonad presumably predisposed to the torsion, which occurred during the time the epididymis was descending the canal and when the testicle was unable, owing to its large size, to enter the inguinal ring. At this point, owing to cessation of androgen secretion by the now necrotic testicle, further descent of the epididymis was inhibited. Hence, at operation, the gubernaculum still measured 3.75 cm.

Another possible cause of the testicular necrosis is infarction following occlusion of the spermatic artery

(*Concluded at foot of adjoining column*)

FIG. 1.—Horse, showing flank laparotomy site, five days after operation.

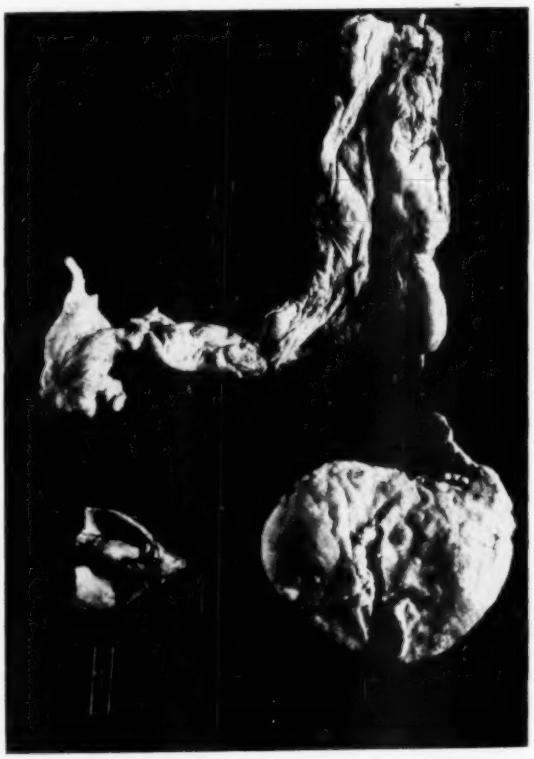

FIG. 2.—Tissues removed at operation.

Refresher Article No. 17

Bloat in Cattle

BY
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Introduction

DISTENSION of the rumen with gases, with acute discomfort and even death of the animal is a common condition in cattle, and has been recognised for many years under the name of bloat. It often affects individual animals following obstruction of the oesophagus with a small turnip which prevents the eructation of the ruminal gases normally produced. But these cases are few in number and as such are unimportant. The type of bloat which is associated with the nature of the feed presents an entirely different problem: here it is common to find several, if not all, of the herd affected in some degree one hour or less after they are put to graze a particular crop and the death of some of the cattle often results. It is generally accepted that the incidence of this acute type of bloat has increased since so much land has come under the plough and been sown down to new leys, often after heavy manurial dressing, and wider use made of certain fodder crops such as kale.

In many of the cases of acute bloat encountered in the field, it has been found that the gas which distends the rumen is above the main mass of foodstuff and will readily escape through an inserted cannula. In other cases the gases are thoroughly mixed with the ingesta giving rise to the so-called "frothy" type of bloat and puncture of the rumen with trocar and cannula provides no relief as the instrument is quickly blocked by solids. Studies of the gases produced in the rumen have shown that they consist of carbon dioxide (about 64 per cent.) which is produced by micro-organisms from a variety of organic substances, methane (about 28 per cent.) derived from cellulose by bacterial action, and small quantities of nitrogen, hydrogen, hydrogen sulphide and oxygen. The gas in the rumen is eliminated mainly by eructation but some, particularly the carbon dioxide, diffuses through the wall of the rumen into the bloodstream and is excreted via the lungs.

Economic Importance

It is not possible to obtain an accurate estimate of the severity of the bloat problem in this country. There is no doubt that it varies from year to year depending to a great extent on the climatic conditions that prevail at or about the spring flush of grass. For example, during a survey carried out in England and Wales in 1951 a total of 287 outbreaks of bloat were reported whereas in 1952 there were only 21. In the earlier survey the proportion of grazing animals which developed bloat varied between 2 per cent. and 16 per cent. and the mortality rate among the affected cattle was generally 15 per cent. to 50 per cent. but in rare cases reached 100 per cent. The full economic loss from bloat cannot be measured in terms of dead animals—there is always loss in milk production during bloating and the seriously affected cows may not return to full lactation. Outbreaks of severe bloat may completely upset the normal routine on a farm; the farmer may find himself with a rich pasture on which he dare not put his cows except for short periods under surveillance and he is compelled to use up his reserves of hay or silage.

Botanical and Climatic Factors Involved

The majority of the cases of bloat in England and Wales occur on young actively growing pastures with a high clover content but permanent pastures rich in clover have also been involved. In the western counties of England bloating on kale during the winter months has been a problem in certain years. As far as pastures are concerned there has always been a tendency to regard the lush clover-predominant sward as being the cause of bloat although serious outbreaks have been seen on pastures so short that it was almost impossible to obtain a sample of herbage for analysis. Whether there is any correlation between weather and the occurrence of bloat is difficult to determine as it has been reported under many and varied conditions from "clear and dry" to "wet and humid." It was observed that widespread outbreaks of bloat occurred in south-west England in 1951 on the last day of April when warm weather was superseded by a cold east wind and rain. Do the additional demands of the peripheral circulation impede the absorption of CO_2 by the ruminal blood supply?

It is quite often observed that some cows in a herd are repeatedly affected and this association has often been remarked on while others under identical conditions of grazing and management never show any suspicion of a distension of the rumen. It has been suggested that the tendency to bloat is an inherited characteristic but there is reason to believe that if the herbage is sufficiently "bloat inducing" even the insusceptible cows will develop some degree of bloat.

Spontaneous Emasculation.—*Concluded.*

by an embolus from a verminous aneurysm, or actual thrombosis of the spermatic artery itself due to *Str. vulgaris* larvae. Hobday (1923) has recorded the presence of such larvae in the abdominal testicle of a cryptorchid horse.

Acknowledgment.—Mr. H. A. Burgess very kindly photographed the specimens shown in Fig. 2.

Reference

HOBDAY, F. T. G. (1923). *Cryptorchid Castration* in Wooldridge's "Encyclopaedia of Veterinary Medicine and Surgery." Vol. II, 987. Hodder and Stoughton, London.

Causes of Bloat

It is only natural that bloat has received considerable attention and that a number of theories have been formulated as to its cause.

1. *Rapid Production of Gas*

The view was held for many years that bloat was simply the result of gas which was produced in the rumen in greater volume than could be eliminated by belching. The tendency was to regard the greedy eater which consumed large quantities of succulent herbage in the shortest possible time as the most likely victim. Recent work has shown that the amount of gas produced by different foods varies considerably and the available evidence suggests that the animal can by eructation get rid of the gases normally produced and that some other factor is involved which leads to bloat. Observations of animals on bloat-prone pastures have shown that the food intake may be quite modest and that the onset of bloat may quickly lead to cessation of grazing.

2. *Paralysis of Muscle*

Paralysis of the muscles concerned in the act of belching was widely believed to be responsible for the onset of bloat in the grazing animal. A number of substances were incriminated by workers in this country and abroad.

(a) In Wales, Evans and Evans (1949) postulated that cyanide was an important agent in the production of bloat on leguminous plants. When this was followed up by other workers it was shown that the bloat incidence on clover was not related to the cyanide content. Also, other plants which were rarely involved in bloat-producing pastures were found to contain very much more cyanide than many types of clover.

(b) Ferguson (1950) found a flavone in lucerne juice which had a paralysing action on the muscle of isolated rabbit gut. He was unable, however, to produce bloat in the bovine with lucerne juice and concluded that it was unlikely that the flavones played a part in the production of bloat (Ferguson & Terry, 1955). It is noteworthy that bloat could not be produced by the flavones with or without cyanides.

(c) In Ireland, Kerr and Lamont (1946) observed a high incidence of bloat in animals following a second injection of trichomonas antigen. They believed that the bloat was the result of an allergic reaction with excess production of histamine and claimed success in treatment with 3 to 5 ml. dose of adrenalin. Carmichael (1951) working on the assumption that bloat on clover was associated with increased production of histamine used one of the anti-histamine preparations and reported that there was a good response especially where the animals had been suddenly changed to a clover ley. On the other hand in South Africa and New Zealand (Johns, 1954) adrenalin and anti-histaminics were found to be dangerous and in some cases increased the severity of the bloat.

(d) Other substances which have been considered as responsible for paralysis of the muscles of the rumen include ammonia which is produced when there is an excess of protein with a deficiency of carbohydrate in the rumen, toxic gases such as carbon monoxide and hydrogen sulphide and anticholinesterase derived from plants such as clover. Closer examination of these substances has failed to support the claim that they can be the primary causes of bloat.

(e) Cole (1945) expressed the opinion that bloat was the result of some interference with the act of belching and that a stimulus in the form of sharp fibrous food was necessary to maintain the normal belching. If the diet consisted of succulent herbage low in fibre there was less efficient belching. This theory was supported by the beneficial results obtained when animals were fed straw or hay before they were turned on to a bloat-producing pasture. The " lack of roughage " school of thought had many adherents in this country and attempts were made to devise a ley seeds mixture which provided a suitable balance between grass and clover. Tall fescue after it has been closely grazed recovers almost as quickly as the clover and maintains a reasonably safe balance between the two.

3. *Saponins*

Saponins, which according to Dorland's Medical Dictionary are " a group of glycosides* widely distributed in the plant world and characterised by (1) their property of forming a durable foam when their water solutions are shaken . . ." have been incriminated as responsible for some forms of bloat by a number of workers. Ferguson and Terry (1955) extracted saponins from lucerne and found that the preparation could produce bloat. When expressing the juice from fresh lucerne with a roller mill, the amount of foam produced was a useful indication of its power to cause bloat. In California a number of saponins were found to be present in lucerne and an extract given to animals *per os* caused foaming bloat and death in 1½ to 2½ hours. It would seem that under natural conditions the saponins are released slowly from the ingested plants and the effects on the animals would probably be less severe than where the saponins are extracted mechanically and given in considerable amount *per os*. It has been suggested that the foaming in the rumen of a bloated animal is also partly due to the protein fraction of the ration but whatever part the protein may play it seems definite that saponins play the major role in " frothy " bloat.

Prevention of Bloat

Efficient pasture management can help to avoid the trouble. After a pasture is closely grazed and then rested the clover tends to recover more quickly than the grasses so that when pastures are used intensively there is a tendency for the clover to become dominant in the sward and it may rise to 85 per cent. or more of the herbage. It is not possible to assess the proportion of grass to clover needed to avoid the risk of bloat. In this country it has occurred on pastures with a proportion of clover as low as 33 per cent. of the sward but it is believed that if there is less than 50 per cent. of clover present

* A glycoside is a compound which contains a sugar molecule, if the sugar constituent is glucose it is a glucoside.

it is usually safe. A number of seed mixtures have been tried to provide a suitable balance between clover and grasses. One which has given promising results in the West of England contains tall fescue. After it has been closely grazed this species of grass recovers almost as quickly as the clover and, therefore, maintains a reasonably safe balance in the herbage.

Controlled Grazing

1. Controlled grazing can contribute to the prevention of bloat by ensuring that the grazing animal eats both leaf and stem whether clover or grass, and that it cannot selectively graze the more dangerous clover. This is done by using an electric fence, which is moved across the field so that the cows have access to a succession of narrow strips of pasture. Although this method generally reduces the number of cases of bloat, it may also reduce the food intake and as a result, the milk yield.

2. Another method of controlling grazing is to mow strips of herbage, allow it to wilt and then to let the herd graze it as it lies on the ground. The wilted herbage may be carted to the animals and fed in the stalls as in zero grazing.

3. Grazing a potentially dangerous herbage for a limited period and then moving the herd on to old pasture has been advocated but it is a risky procedure and the animals should be watched while they are grazing the dangerous pasture.

Feeding of Roughage

The feeding of roughage in the form of hay or oat or barley straw shortly before the animals are turned out on to dangerous pastures has been practised for many years; it does not, however, appear to be an entirely reliable method of prevention unless the roughage is fed overnight.

Anti-foaming Agents

A number of anti-foaming agents have been used to prevent the frothy type of bloat. These agents can be given as a drench or in a little food, but it appears that they are lost rapidly from the rumen and even in rather large doses they rarely protect for longer than 4 hours.

These agents can also be added to the water trough but here again protection does not last long and the cow may not drink often enough to obtain complete protection.

Emulsified vegetable oils were found in New Zealand to give excellent protection against bloat when they were sprayed on the pasture just before the cattle were turned in to graze. The method was developed by Reid (1955) who found that peanut oil was the most satisfactory as it had little effect on the flavour and characteristics of the butterfat and did not cause any depression of milk yield. In Australia tallow was found to possess similar properties, and, being cheaper, tended to replace peanut oil (Flynn, 1959).

It has proved difficult to arrange for trials of this method in this country. When the earlier experiments were in progress abroad linseed oil was thought to be satisfactory and the necessary ingredients for linseed oil emulsion were sent in 1956 to a number of Veterinary Investigation Centres in preparation for the next "bloating" season. Then it was found in New Zealand that when linseed oil was used over a long period it had undesirable effects on the flavour of milk and butter. There was a complete lack of suitable outbreaks of bloat until 1958 and these subsided spontaneously before any action could be taken. Two outbreaks of bloat were reported in 1959, and while on one farm no further cases occurred, the trial results on the other were quite striking. Three cases of mild bloat occurred on 2 days among 10 cows throughout the trial period of 10 days on the treated pasture, whereas 9 cases of bloat occurred in seven days among 5 cows throughout the trial period of 10 days on the untreated pasture (Loosmore, 1959).

The application of oil emulsion to the pasture is best done by a low volume spraying machine and jet size 00 has delivered the correct amount in the trials conducted at Reading. It is essential to restrict the cattle by electric fence to the area which has been sprayed and a conservative estimate should be made of the area which will be grazed by each cow over a period of 24 hours. This will depend on the length and density of the herbage but will approximate 30 sq. yards. Each animal should be able to acquire 6 ounces of oil during the 24 hours. As rain washes away the emulsion it is safer to apply it each morning and then move the electric fence forward. The emulsion is made up as follows:—

Raw linseed oil	5 gallons
Water	10 gallons
Lissapol	3 pints

Eighteen and a quarter gallons of emulsion per acre gives 6 oz. oil per 30 sq. yards. A 5 yd. front × 6 yd. strip (30 sq. yd.) is needed per cow per day. Allow 18 oz. emulsion for each 30 sq. yards, i.e. for each cow.

A herd of 20 cows will require 20 × 18 ounces = 2¼ gallons emulsion per day.

This amount can be made up with:—

Raw linseed oil	6 pints
Water	12 pints
Lissapol	9 ounces

These small amounts can be applied by hand sprayers such as the knapsack but it is not easy to apply the correct amount and the emulsion renders the grass extremely slippery.

In Australia and New Zealand peanut oil emulsion is widely used on farms where bloat has been a problem for years. It is used at the rate of 3½ ounces of emulsion per cow per day and is increased if there is any suspicion of bloat in the grazing animal. The peanut oil emulsion consists of:—

7 parts pure peanut oil
1 part Lissapol (10 per cent.)
28 parts water

Tallow emulsion is, as stated, also widely used in South Australia but it is much more troublesome to prepare as it needs ample hot water and must be applied to the pasture while still warm.

Treatment

The treatment to be adopted will depend entirely on the severity of the attack. If a number of animals

(*Concluded at foot of page overleaf*)

Annotations

Blood Coagulation

Modern Concepts of the Mechanism of Haemostasis

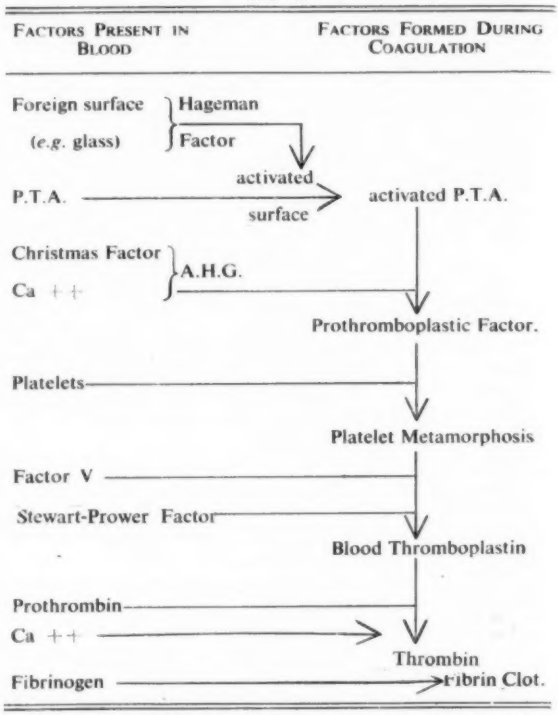
MUCH new knowledge has been accumulating during the past few years, which helps to explain certain phenomena concerned with damaged tissues and the process of haemostasis. It is the purpose of the following brief notes to give an outline of the more significant of these findings.

I.—Early Stages of Blood Coagulation; the Rôle of Contact with Glass

The trigger mechanism which starts the coagulation process when blood is allowed to clot in a glass tube has been an intriguing problem for many years. Recently it has been shown that the glass surface itself is an essential part of this process (Margolis, 1957). Two new coagulation factors have been postulated: Hageman Factor (Ratnoff & Colopy, 1955; Ramot, Singer, Heller & Zimmerman, 1956) and Plasma Thromboplastin Antecedent (P.T.A.) (Rosenthal, Dreskin & Rosenthal, 1953, 1955). According to recent work the reaction of blood to contact with glass occurs as follows:—

Hageman Factor is adsorbed onto the glass from blood plasma. In so doing, Hageman Factor is removed from the blood and the glass surface becomes activated, but the process is reversible and Hageman Factor can be eluted from the glass (Hardisty & Margolis, 1959). The P.T.A. in plasma reacts with this surface and so itself becomes activated. Activated P.T.A. forms a prothromboplastic factor by combination with a product produced by the interaction of Christmas Factor and calcium ions in the presence of antihaemophilic globulin (A.H.G.) (Bergsagel, 1956). Platelets undergo viscous metamorphosis and produce blood thromboplastin in the presence of Factor V and the Stewart-Prower factor. This chain of reactions is illustrated in Fig. 1.

FIG. 1.



Blood thromboplastin formation is probably relatively weak and slow in the haemostatic process.

Bloat in Cattle.—*Concluded.*

become slightly bloated while grazing, the herd should be quietly removed from the pasture and kept under observation for an hour or two or until the bloating subsides. Appropriate measures can then be taken to prevent a recurrence when the animals return to the grazing.

In more severe cases 4 to 6 fluid ounces of vegetable oil such as linseed or peanut can be given by mouth. Drenching with peanut oil relieves a bloated animal within 20 minutes whereas it may take 2 hours for the condition to subside naturally. The silicones or even the common household detergents are also of value when given orally, but none of these appear so effective as a vegetable oil.

When the animal is seriously distressed as the result of bloat the trocar and cannula or a wide bladed knife inserted into the rumen in the hope of releasing the gas seems to offer the only hope of success. If this fails to relieve the pressure and the cannula becomes obstructed with frothy ingesta then rumenotomy may be necessary to save the animal's life. There will almost certainly be little time for careful surgery, but after the animal has survived the critical stage of the attack the wound can be cleaned and sutured and with appropriate antibiotic treatment the animal will make an uneventful recovery.

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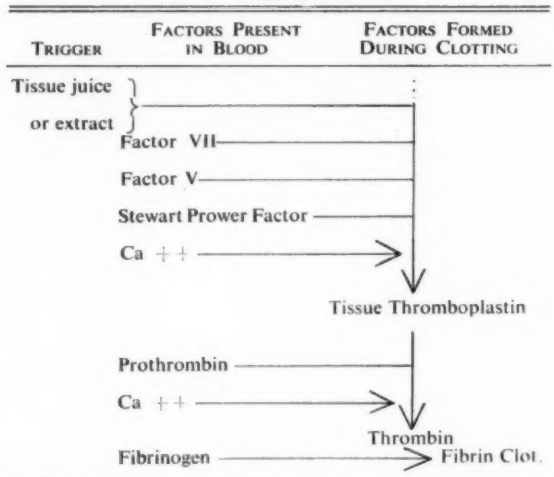
Tissue thromboplastin can be formed within a few seconds from tissue juice in the presence of Factors V, VII and the Stewart-Prower (Fig. 2).

FIG. 2.



Platelets undergoing viscous metamorphosis release 5-hydroxytryptamine (5-H.T.) as well as a phospholipid necessary for the formation of blood thromboplastin. 5-H.T. is a potent vasoconstrictor and may therefore be an essential part of the haemostatic process (Hardisty & Stacey, 1957).

Perhaps a conclusion may be drawn from this work which is of wider application. Glass cannot be regarded as inert in biological investigations. Indeed, the preliminary evidence available at this time suggests that other surfaces, such as silicone, are less active, but not inactive.

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II.—Tissue Mast Cells, Histamine and Heparin

Tissue mast cells were first described by Ehrlich in 1877 and were so-called by him because they occur most commonly in well-nourished connective tissue ("Mastzellen" = well-fed cells). He also observed that the cytoplasmic granules of these cells were able to change the colour of toluidine blue (metachromasia). In 1937, Jorpes and his colleagues found a good correlation between the mast cell content of tissue and its heparin content. Later, Riley and West (1953) demonstrated a good correlation between the histamine content of various tissues and their mast cell population. Riley (1959) presented the evidence that mast cells are rich in both histamine and heparin while Sanyal and West (1956) had shown that a complex consisting of histamine base, one part, and the acid heparin, twenty parts, could be formed *in vitro* and closely resembled mast cell granules.

Mast cells occur in large numbers in subcutaneous tissue and in the capsules of many organs (liver, lungs and mesentery, etc.). The cells may be regarded as a store of readily available histamine and heparin since they are very easily degranulated by physical injury or by a histamine-releasing agent. Many compounds are able to release histamine and the subject has been well reviewed by Paton (1957). Substances which are capable of releasing histamine clearly have dangerous potentialities when used therapeutically and it must be emphasised that the ability of a compound to release histamine may vary widely in different species. A good example of this would be morphine which is a potent histamine liberator for the cat (Feldberg & Paton, 1951), and it will be agreed that a cat which has been given morphine exhibits many signs of histamine poisoning.

When a superficial injury occurs, mast cell granules will be released in the affected tissue. There will then become available quite large amounts of histamine and heparin. The function of heparin in tissue is the subject of much speculation. West (1959) suggests that it may be more concerned with events in the tissue rather than with blood anticoagulation. Heparin is chemically closely allied to hyaluronic acid and it has been suggested (West, *loc. cit.*) that mast cells secrete a heparin-like substance which may be desulphated and then acetylated to form hyaluronic acid. Hyaluronic acid is an extracellular component of connective tissue—"intercellular cement." Heparin which is free interferes with blood coagulation in several ways; the main effect is antithrombic so that the fibrinogen-to-fibrin reaction is impaired or blocked. Heparin also reduces the ability of blood to react to the trigger mechanism for clotting of contact with a foreign surface.

Histamine released into tissue produces marked increase in capillary permeability together with dilatation of local blood vessels. There is, therefore, a reduction in local blood pressure, and these effects together may produce complete stasis of the blood in the tissue concerned. West (1959) considers that ". . . the function of histamine is concerned with the defence of the body, since its release is followed by a temporary mobilisation of the loose mesenchyme" (*loc. cit.*, page 531).

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XUM

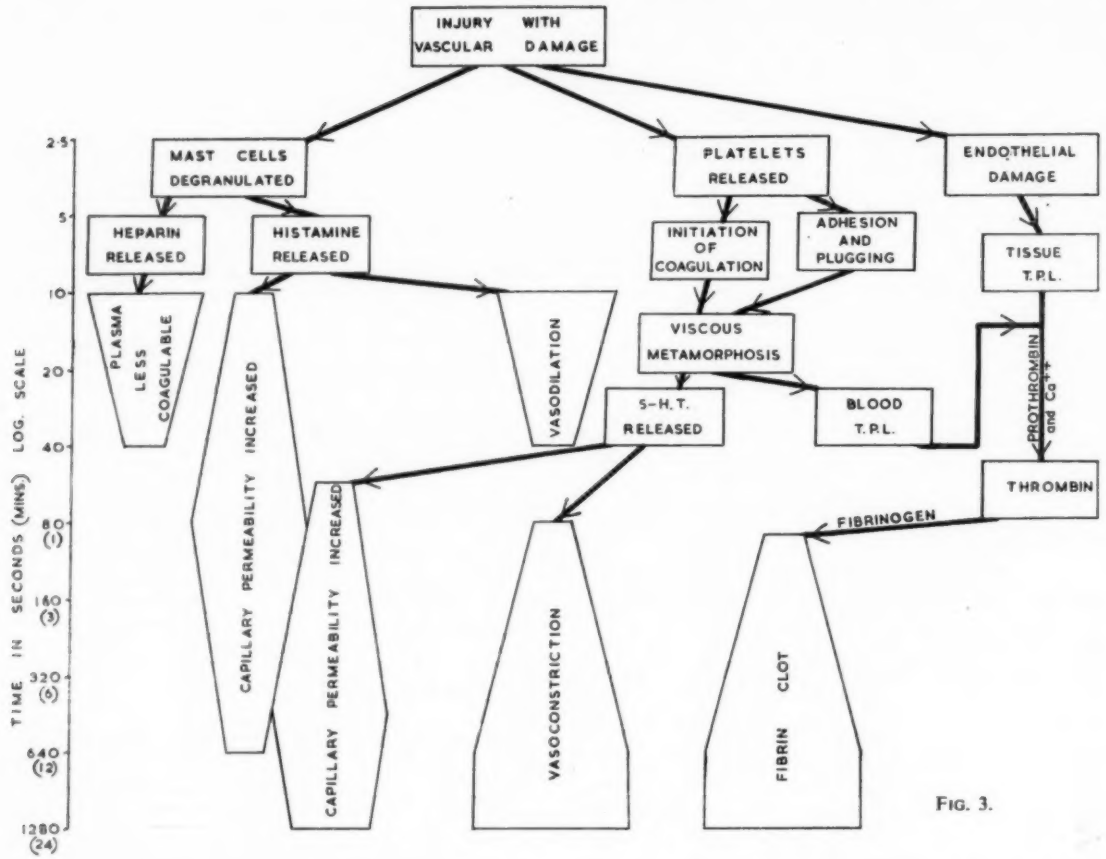

FIG. 3.

III.—Local Tissue Response to Injury, with Special Reference to the Mast Cells

In the two previous short notes I have given a review of some of the newer contributions in two of the more academic fields of physiology It is possible to draw these together and represent part of the local tissue response to injury graphically. An attempt to do this has been made in Fig. 3.

A chain of very complex reactions begins as soon as damage occurs in tissue. Fig. 3 attempts to record some of these and especially those that are a consequence of mast cell degranulation. Whenever skin and subcutaneous tissues are damaged, for instance at surgical interference, mast cells are degranulated with release of histamine and heparin. The exact rôle of these two agents remains obscure at the present time, but some effects are known. Capillary permeability, first produced by histamine, is increased after a delay of about a minute by the 5-hydroxytryptamine (5-H.T.) released as a result of the metamorphosis of blood platelets. But 5-H.T. is a potent vasoconstrictor so that the original vasodilatation produced by histamine is counteracted and eventually replaced by vasoconstriction. This latter occurs at just about the time that normal blood would clot so that severed vessels are "clamped down" onto the clotted plug which has formed within them. Haemostasis is thus complete.

During the first minute or so after injury, thromboplastin is generated both from the sap of the injured cells (tissue thromboplastin—the extrinsic blood clotting system) and from blood as a result of the trigger mechanism provided by contact with a foreign surface—that is a surface other than vascular endothelium (blood thromboplastin—the intrinsic blood clotting system).

It is possible to give an idea of the likely rôle of the mast cells in injury. Since they can be regarded as "store houses" of histamine and heparin, the cells may be regarded as storing potent agents for the local defence of the body against injury. Bacterial invasion is not directly antagonised by this system and defence against such organisms is not considered here. But it will be seen that where tissue rich in mast cells is extensively damaged, for instance by major surgical interference with the skin or by accident involving a large skin area, much more histamine and heparin will be released than is needed or consumed locally. These escape *via* the blood system and produce symptoms resembling those of surgical shock, with or without hyperheparinaemia and consequent hypocoagulability of the blood.

Further, certain agents used therapeutically are histamine-releasing agents so that more mast cell degranulation follows in remote areas of the body. Such agents as morphine, curarine, dextran, blood serum of a different species, polymyxin and many diamines, diamidines and diguanidines (Paton, 1957) release histamine. The effect of these various agents is highly variable in different species.

Mast cell degranulation, therefore, is a part of the normal body defence against local injury. But if this degranulation is too extensive, or if it occurs in tissues remote from those injured, the effects may be highly dangerous. The avoidance of excessive damage to tissue, and especially tissue rich in mast cells, is particularly worth while in surgical interference. If cases are presented where mast cell degranulation is already excessive, logical treatment would consist of antihistamine drugs by injection to combat the excess of histamine probably combined with a vasoconstrictor such as adrenaline if blood pressure is adjudged to be dangerously low. In dogs, shock may be accompanied quite commonly by heparinaemia and in these cases injections of protamine sulphate or toluidine blue are beneficial. Longer term treatment may be by injections of one of the glucocorticoids, such as cortisone, hydrocortisone or prednisolone, etc., which have the ability to delay the resynthesis of histamine *in vivo* (Halpern, 1956).

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R. K. A.

Displacement of the Bovine Abomasum

A member of the profession, Mr. Eric I. Williams, has had the honour of being elected a member of the Societé Véterinaire Practique de France, and in consequence was invited to contribute a clinical paper to the members. He chose for subject Displacement of the Bovine Abomasum, a condition not generally recognised in France. A summarised translation of Mr. Williams's paper is as follows:—

This disorder was described for the first time by Begg (1950) and by Ford (1950). The fundic portion of the abomasum folds back on itself, is then pushed under the ventral section of the rumen towards the left side, and becomes incarcerated between the rumen and the left abdominal wall.

The displaced organ becomes tympanitic, and in very acute cases the rumen is pushed back to the middle of the abdominal cavity.

Symptoms

In some cases there occur symptoms of slight indigestion, just one or two weeks before calving, the condition being accompanied by diarrhoea and slight inappetence.

In the majority of cases the symptoms appear a few days following calving. Sometimes the attack is acute, with total loss of appetite and tympany of the rumen. The most common clinical picture may be defined as a vague post-parturient digestive upset.

In all the cases observed there was a sudden loss of weight in the subject, combined with a great reduction in the milk yield. It has been noted several times that the animal takes care to avoid lying on the left side. The temperature, pulse and respiration are usually normal; however, in prolonged cases the temperature is slightly subnormal. Palpation and auscultation of the rumen in the left flank reveal nothing abnormal in the early stages of the illness. Daily observation of suspected cases will bring to light the gradual depression of rumen sounds and also it becomes impossible to palpate this organ which has been pushed over towards the midline. A closer examination may often reveal the displaced organ as a tympanitic swelling directly behind the left ribs. Auscultation of this area of the posterior ribs elicits abnormal sounds which are produced by gas passing through the abomasum with unusual resonance.

These borborygmal sounds are diagnostic, but it must be remembered that auscultation has sometimes to be prolonged to detect them. After what we have seen, we believe that the majority of cases must be observed for several days before being able to hear the sounds and establish that the abomasum is displaced.

Treatment

This may be carried out by one or other of the following methods:—

1. In some cases, taking the cow off its whole diet (both food and water) for 2 or 3 days may be enough.

2. The replacing of the organ.

(a) *Without surgical intervention:* the animal is cast and laid on its back and is suddenly "jerked" onto its left side. This is repeated several times. Taking the animal off food during the days preceding this intervention is a great help.

(b) *Surgery*, when one of the following techniques should be chosen:—

Laparotomy in the left flank, the subject standing up as for a gastrotomy. In a definite case it is easy to locate the abomasum, which is a pale organ with thin walls blocked between the rumen and the abdominal wall. It is wise to relieve the tympany of the displaced organ before undertaking any kind of manipulation. The replacement of the abomasum by pushing it back with the hand usually fails, so we recommend a modification of Jennings's (1958) method. This consisted of passing the arm over the rumen, reaching into the right flank, and seizing the displaced viscus under the rumen, then, by gentle pulling, removing it from its displaced position and drawing it towards the right side. Jennings says that to hold the abomasum in place he fixes the omentum to the dorsal surface of the rumen.

Double laparotomy as advocated by Wood (1957). This author suggests opening the left flank as in gastrotomy, which makes it possible to relieve the tympany of the displaced abomasum: a similar opening is then made in the right flank. The duo-

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The Nuffield Institute of Comparative Medicine

BY

R. N. T-W-FIENNES

Pathologist, Zoological Society of London

THE announcement of a grant of £100,000 to the Zoological Society of London for the foundation of an Institute of Comparative Medicine is an indication of the continuing interest which the Society has had, from its inception, in scientific research and in particular in the health and welfare of its animals. The objects of the Institute will be "to study disease in whatever form it occurs in different animal species, and to determine variations in pathological processes which result from common causes." This research will be a logical, but marked, advance on the work which has previously been possible.

The Society itself was founded in 1826 and the Regent's Park Gardens were opened in 1828. A medical attendant was appointed in the following year to attend 3 times in each week and more often when necessary, to prescribe for and examine all the animals, and to keep a record of observations and practice. It seems that the results were unsatisfactory, because in 1833 there was an inquiry into the medical care of the animals. The Society then appointed a medical superintendent who was to attend on Mondays and Thursdays, and inspect every animal and give directions. He was also to be ready to attend in an emergency, a room with a case of instruments and medicines being provided. The medical superintendent was also to make *post-mortem* examinations to ascertain the cause of death.

The person appointed was William Youatt, a well-known veterinary surgeon in practice in Wells Street, Oxford Street. He was the author of treatises on the horse and the dog, and was founder (and editor for many years) of *The Veterinarian*. He continued in his post at the Gardens until his death at the age of 71 in 1847.

Two of Youatt's manuscript day books are still in the possession of the Zoological Society and are worthy of study. The books are written in an old-fashioned, copperplate hand, and reveal a careful and conscientious personality with a sense of duty and devotion to his charges. Much of the diagnosis makes strange reading to-day, but terminology such as "bloody flux" if old-fashioned, is yet intelligible as meaning "dysentery." Some of the records are entertaining as when he records the anxiety he felt at the report that a penny had been fed to the ostrich by a person "in the garb of a gentleman." The ostrich came under observation for many days, but to Youatt's astonishment suffered no ill effects.

Following Youatt's death, the care and treatment of the animals was left in the hands of the Superintendent with occasional advice from the staff of the Royal Veterinary College at Camden Town. In 1865, Professor T. H. Huxley, F.R.S., then a member of the Council, was apparently dissatisfied with the use of the material in the Gardens and a Committee was appointed consisting of himself, Dr. J. E. Gray, F.R.S., of the British Museum, Professor W. H. Flower, F.R.S. (later Sir William Flower), Professor G. Busk, and the Secretary, "to consider the mode by which the animals dying in the Gardens may be disposed of with most benefit to zoological science." The Committee recommended that regular *post-mortem* examinations, which had not been made since Youatt's death, should be "carried out in a systematic manner in the interests of zoological and pathological science." For this purpose proper facilities were to be provided, and a qualified person was to be appointed with the title of prosector. In due course these recommendations were accepted: Dr. James Murie, a native of Glasgow and a Glasgow graduate in medicine, was appointed prosector. After Dr. Murie's retirement in 1870 no officer was

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Displacement of the Bovine Abomasum.—*Concluded.*

denum can be recognised and followed as it descends to the pylorus. The displacement is corrected by traction on the pylorus.

To complete the operation, the section of the omentum which forms a part of the pylorus is included in the first layer of sutures, closing up the opening in the right flank. This is to prevent displacement occurring again.

Laparotomy of the right flank: the opening in the right flank being made, the surgeon passes his hand behind the rumen into the abdominal cavity. The displaced organ is located and by gradual traction returned to the right side.

Opening (la ligne blanche): just behind the xiphoid appendix. The animal is anaesthetised and cast lying on its back. A midline incision is made just behind the xiphoid cartilage, and the displaced organ is easily replaced.

General Comments

The most striking result found is the immediate recovery (both of appetite and rumination) which follows correction. We have, however, found that in 2 cases where surgery was undertaken, a general peritonitis with adhesion had already occurred, and in one of them there was ulceration of the abomasum. These 2 animals were slaughtered.

[*Note.*—Since the publication of this article, the author has encountered an interesting case in a cow, two months prior to calving, which developed a vague digestive upset. A large "sausage"-shaped swelling was evident in the left flank, immediately posterior to the ribs. Observation of the patient from behind showed a distinct lop-sided appearance of the abdomen. However, careful examination of this case revealed a displaced gravid uterus (and *not* abomasum) which was easily corrected by casting the animal and gentle rolling.]

appointed who was qualified to do serious pathological work and no complete records are extant: it was not until 1903 that a trained pathologist was again appointed. During this period, however, the Hunterian Collection at the Royal College of Surgeons was considerably augmented by material collected by Sir Richard Owen and his successors as conservators of the Royal College from the menagerie in Regent's Park. Many papers by a number of distinguished scientists in anatomy and pathology, based on studies at Regent's Park or arising from material obtained from the Zoological Gardens, are published in both the Proceedings of the Zoological Society of London and in the Transactions. Particular mention should be made of Sir Richard Owen, Dr. Edward Crisp, Sir John Bland-Sutton, Sir Frederick Treves and Sir Grafton Elliot-Smith.

Since that time work on anatomy and pathology has been associated with a number of persons who subsequently made outstanding contributions to science, some of whose names are given below. From 1907 to 1917, the pathologist was H. G. Plimmer (later Professor H. G. Plimmer, F.R.S.); 1918 to 1924, Dr. N. Lucas, later of the Lister Institute and well known for his work on fertility in marmosets under ultra-violet irradiation; 1924 to 1938, Dr. H. H. Scott (later Sir Harold Scott, Director of the London School of Tropical Medicine); 1927 to 1931 the anatomist was Dr. S. Zuckerman (later Professor Sir Solly Zuckerman, F.R.S., the present Secretary of the Zoological Society). From 1928 to 1946 a pathologist was appointed, who was, until 1931, additional to the prosector; the person selected was Colonel Hamerton, a retired officer of the R.A.M.C., and a pioneer of sleeping sickness research in Uganda where he worked with Major-General Sir David Bruce.

During these years under the direction of so many distinguished men, the Society made important contributions to scientific knowledge, but more perhaps in the disciplines of anatomy than in those of pathology. Nevertheless, there exist unbroken records since 1908 of careful and painstaking pathological examinations made on virtually all animals which have died in the Society's collections. These have never been fully analysed, but the more interesting information has been published annually in the Proceedings of the Zoological Society of London in the form of reports presented either by the prosector or by the pathologist. Analysis of these records is an obvious task which requires to be undertaken.

From the appointment of Colonel Hamerton in 1928 until the departure of Dr. Zuckerman in 1931, there were two officers, a prosector in addition to a pathologist. Colonel Hamerton did not retire until 1946, having held the office of pathologist for 18 years. The annual pathologist's reports during these years contain a number of interesting studies. He was followed by Dr. Rewell who was the Society's pathologist for 2 years. Following his resignation Dr. W. C. Osman Hill, an anatomist and acknowledged authority on primates, was appointed as prosector and thus shared the responsibility for both anatomical and pathological studies. In 1956, the Council of the Society again decided to appoint two officers, the object being to separate the work on pathology and anatomy in order that detailed research on the former might be undertaken. The appointment of the present holder to the post of pathologist coincided with the completion of the new hospital building with associated pathology laboratories. A resident veterinary officer, O. Graham-Jones, M.R.C.V.S., had been appointed some 5 years previously: thus a self-contained medical and pathological unit came into existence.

In planning the Society's medical unit it was regarded as essential that a proportion of the time of staff should be devoted to research work. Unfortunately, this could plainly be only of an *ad hoc* nature related to the day-to-day needs of the animals in the Society's menageries. However, a diversity of material from animals that had died was being supplied regularly to a growing number of research workers, both medical and veterinary, for purposes of comparative pathological study. In some cases workers developed their own line of approach from the study of this material; in other cases the Society's staff were able to prosecute their researches on a collaborative basis with scientists attached to other institutions. In this way a number of problems have been investigated in collaboration with other workers; the main subjects have been a study of atherosclerosis and other manifestations of circulatory diseases, a study of shock and "stress syndromes," and a study of various osteodystrophic diseases. Other work has been done on diseases of the skin, diseases of the kidneys, diseases of the alimentary and respiratory systems and certain infectious conditions.

The Secretary of the Zoological Society, Sir Solly Zuckerman, considered progress on these lines sufficiently promising to warrant an approach to interested organisations for funds, which would allow further development. The possibilities were investigated by the Nuffield Foundation which decided to make available a contribution of £100,000 for the establishment of the new Nuffield Institute of Comparative Medicine and the foundation of two senior research fellowships.

The approach to human and veterinary medical problems by a study of the wide species spectrum is virtually a new concept. There have been many studies and reports of disease in captive wild animals, the majority of which are recorded in Halloran's (1956) Bibliography. Much of the material quoted in this work comes from publications of the Zoological Society of London and of the Penrose Institute of Comparative Pathology in Philadelphia. The records of the Philadelphia Zoo up to 1921 have been made available in Fox's (1923) "Diseases of Captive Wild Animals." The study of disease in animals both in the wild and in captivity is thus not new, but the concept of using such studies as an approach to the diseases of domestic animals and man is an important step forward.

The lines of research to be developed in the new

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News and Comment

R.C.V.S. DISCIPLINARY COMMITTEE

The Committee met at the Royal College on May 27th under the chairmanship of Mr. T. M. Mitchell. Mr. E. V. Falk was legal assessor.

Mr. Peter George Rolls Wilson

The Registrar reminded the Committee that Mr. Wilson had been before them on December 4th, 1958, on a charge that on June 17th, 1958, at Hay on Wye in a police station he was guilty while intoxicated of disorderly behaviour contrary to Section 12 of the Licensing Act, 1872. The Committee had found the conviction proved and that it constituted conduct disgraceful in a professional respect. They had then been informed that Mr. Wilson had appeared before the Committee previously in respect of comparable offences and had been warned as to his future conduct.

Judgment having been deferred for twelve months, Mr. Wilson now appeared before the Committee and had put in three testimonials testifying to his character and behaviour.

The Committee deliberated, after which the Chairman told Mr. Wilson that they were gratified that his conduct since his last appearance before them had been above reproach, and had indeed been commended by various employers. The Committee had decided not to impose the extreme penalty, but to warn Mr. Wilson that any future misconduct would be regarded extremely seriously.

Mr. James Bhattacharjee

The Registrar reported that Mr. James Bhattacharjee was a Director of Veterinary Services in the Republic of Burma. On December 10th, 1954, he was sentenced to two years' imprisonment in respect of nine charges under the Corruption Act of that Republic. The matter had come before the Committee on April 10th, 1957, when they had directed that his name be removed from the Register.

Mr. Bhattacharjee had recently applied for restoration of his name to the Register and had placed before the Committee the fact that the President of the Republic of Burma had granted him a free pardon. Upon enquiry being made by the Registrar as to its effect, it was reported that whilst it did not destroy the fact that he was rightly convicted, it did absolve him in the Republic of Burma from all consequences such as loss of civil rights, and he was in a sense rehabilitated. Mr. Bhattacharjee had also submitted two written testimonials as to his good conduct.

After consideration of these facts, the Committee decided that his name be restored to the Register.

Voluntary Removal—Mr. J. A. Boseley

The Registrar reported having received a letter from Mr. J. A. Boseley in which he said that, having retired from practice there was no object in retaining his name on the Register. It was decided to accede to Mr. Boseley's request to have his name removed.

"MAN AND CATTLE": R.A.I. SYMPOSIUM

From May 24th to 26th some 50 people representative of a wide range both of scientific disciplines and of cattle breeders met together at the invitation of the Royal Anthropological Institute to discuss and critically assess knowledge of the history and the evolution of domestication of cattle throughout the world. Among the 18 papers presented was a section devoted to the use of gene markers as a method of analysing breed structure, interrelationships and descent. Such application of modern genetics has been considerably exploited on the human side in tracing ethnic connexions between races, but among animals it is still a relatively novel and consequently tentative procedure. The veterinary profession was represented at the symposium by papers from Dr. John Hall of the Animal Breeding Research Organisation and Mr. A. L. Ogden of the Animal Health Trust.

Although the profession was not directly represented amongst the papers in those sections approaching the problem from historical, archaeological or socio-cultural aspects, the Royal Veterinary College took up the challenge and a most scholarly contribution from Dr. Peter Jewell, dealing with his own findings on cattle bones from British Archaeological Sites, was widely appreciated. A final and characteristic contribution from Professor Amoroso, whose slides were capable of evoking response from even the most fossilised spectators, set the seal of success on a highly unconventional mixture.

All the contributions and the discussions are to be published together by the R.A.I., and those members of the profession interested in the origins of

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The Nuffield Institute.—*Concluded.*

Institute cannot at present be forecast. Policy will be determined by a governing body under the chairmanship of Professor Sir Roy Cameron, F.R.S., and it would be premature to hazard a guess as to the lines which it may take. At the present time a planning committee, under the Chairmanship of Professor G. Payling-Wright, is at work with the architect, Mr. R. Llewelyn-Davies, in preparing plans for the Institute. It is to be hoped that building will be started within the next 12 months and that the Institute will be ready for occupation in some 2 years' time. All members of the veterinary profession will welcome this new development in medical and veterinary research not only for the light that it may throw on obscure diseases in domestic animals, but because of the opportunities that will now be afforded for veterinary scientists to work in collaboration with their opposite numbers in the medical profession. It is hoped that the new Institute will lack nothing in the way of equipment and facilities and there can be no doubt that studies of the evolutionary and comparative aspects of medicine will produce important results.

References

HALLORAN, P. O. (1955). *Am. J. Vet. Res.* Part 2. **16.** No. 61.

FOX, H. (1923). "Disease in Captive Wild Mammals and Birds." Lippincott, Philadelphia.

modern breeds of cattle should find there good reading for next winter.

DR. DANIEL OWEN MORGAN

Daniel Owen Morgan, University Lecturer in Animal Pathology at Cambridge and former Senior Lecturer in Zoology at the University of Edinburgh, died in Cambridge, after an illness, on November 17th, 1959. He will be remembered by many of his former pupils and by a wide circle of friends and colleagues as an able teacher and research worker who was always approachable and willing to help the student with his difficulties. There can be few men who, although not qualified as veterinarians, so closely identified themselves with the profession and who understood and were willing to help with the solution of its problems. Shortly after his death a small number of his friends thought that the profession and his former pupils might wish to commemorate him, his work for numerous undergraduates, and for agriculture in general. Various schemes were considered, but in view of his interest in teaching and in his College in Cambridge it was decided to try to endow with any monies collected an open named scholarship at St. Catherine's College, Cambridge, for undergraduates who intended to read for veterinary medicine. The Master and Fellows of the College have now formally agreed to establish such a scholarship if the funds are available. During the past few months the sponsors of this appeal have approached several commercial houses and have met with a most generous response. They now appeal to friends and former students of D. O. Morgan to ask for their support to collect the sum of about £400 which is still required to provide sufficient endowment to support this scholarship. It is hoped that such a scholarship, with its openings for undergraduates who read veterinary medicine, will be thought to be a fitting tribute to his memory.

Donations for the fund should be sent to Dr. E. J. L. Soulsby, School of Veterinary Medicine, Madingley Road, Cambridge. It would be a convenience if the envelopes were marked "D. O. Morgan Memorial Fund."

SLAUGHTERHOUSE REGULATIONS

On July 1st, 1960, new construction regulations come into force for existing slaughterhouses in the Borough of Lewisham; the Urban Districts of Benfleet, Essex and Letchworth, Hertfordshire; and the Rural Districts of Hartismere, Suffolk and Pewsey, Wiltshire. As the regulations already apply to new slaughterhouses these five districts will be the first in the country in which the higher standards will apply both to new and existing slaughterhouses.

The Slaughterhouse (Hygiene) Regulations, 1958, and the Slaughter of Animals (Prevention of Cruelty) Regulations, 1958, which partially came into operation on January 1st, 1959, under the Government's policy of raising the standard of hygiene and treatment of animals in slaughterhouses, provided for the deferment of certain requirements relating to the construction, layout and equipment of existing slaughterhouses until such later dates as the Minister might appoint. The appointed day chosen for each local authority area is determined in the light of a recommendation made by the local authority after consultation with the various local interests concerned.

Further Orders will be made at quarterly intervals, appointing dates as appropriate for some 1,200 other local authorities with slaughterhouses.

MR. W. I. MACONKEY

F. J. H. writes:—

The sudden death of Irvine Maconkey from a heart attack came as a great shock to his colleagues of the Animal Health Division. A native of Northern Ireland he was a Veterinary Inspector with the Northern Ireland Ministry of Agriculture before joining Animal Health Division in 1949.

Before coming to Gloucester in 1955, he was stationed at Aberystwyth.

"Mac" who was a man of the highest integrity had a quiet and reserved disposition.

The funeral took place in Northern Ireland. He is survived by his widow and three children to whom we extend our deepest sympathy in their sad loss.

THE PETER WILSON BEQUEST LECTURES

The fourth of these lectures was delivered at the Royal (Dick) School on May 25th. In introducing the lecturer the Principal, Professor Robertson, said:—

"Dr. Fitzpatrick, the speaker in the fourth of our Peter Wilson Bequest Lectures, needs little or no introduction for he is, doubtless, already well known to many in this audience in his capacity as External Examiner in Veterinary Pharmacology. To-day, however, the boot is on the other foot for he is here to give rather than to receive and there may even be an unofficial opportunity after the lecture for some of you to try your hands at oralling him!

After qualifying as a Member of the Royal College of Veterinary Surgeons following a distinguished undergraduate career at the London veterinary school, Dr. Fitzpatrick spent a couple of years in private practice and then, forsaking the fleshpots, he returned to the academic field to take an honours degree in physiology. Then followed a brief spell at the Ministry of Agriculture's Veterinary Laboratory at Weybridge where he studied in particular the pharmacology and toxicology of various rodenticides. Since then, for nearly 10 years now, he has been Lecturer in Pharmacology in the University of Bristol where, in addition to his teaching commitments, he has been an active and capable research worker with a particular interest in the physiology and pharmacology of the reproductive system of the ruminant. He has also found time to visit both South Africa, where he carried out research at the University of Pretoria, and South America where he was visiting Professor at the University of Uruguay. It could be said, therefore, with truth that Dr. Fitzpatrick has studied his subject from many angles both geographical and academic and it is with pleasure that I call upon him to give his address under the intriguing title of "Hormones Old and New."

XUM

R.C.V.S. OBITUARY

We record with regret the death of the following members of the profession:—

LLOYD-JONES.—Thomas Dennis, of Lanrick House, Crewe Road, Nantwich, Cheshire. Graduated London, December 22nd, 1923. Died May 24th, 1960.

MACONKEY, William Irvine, V.O., Animal Health Division, Elmbridge Court, Gloucester. Graduated July 23rd, 1945, at the Veterinary College of Ireland, Dublin. Died May 19th, 1960, aged 48 years.

PHILLIPS, John Gilmour, of 32, Wostenholm Road, Sheffield, 7. Graduated London, June 30th, 1950. Died May 20th, 1960, aged 33 years.

PERSONAL

Dr. C. A. E. Briggs, lately of the National Institute for Research in Dairying, University of Reading, has been appointed Head of the Veterinary and Agricultural Research Department of Pfizer Ltd., Sandwich, Kent.

Professor H. G. Lamont has been re-elected Dean of the Faculty of Agriculture of Queen's University, Belfast. He remains, thus, the first veterinary surgeon upon whom this honour has been bestowed.

Marriage

McLEAN—DUCKETT.—At St. Mary's Cathedral, Glasgow, on May 2nd, 1960, Arthur Alistair McLean, B.V.M.S., M.R.C.V.S., to Mary Duckett, B.V.M.S., M.R.C.V.S.

Birth

KIRKBY.—On May 25th, 1960, at Kaduna, Nigeria, to Audrey (*née* Dunn), wife of W. W. Kirkby, M.B.E., B.SC., M.R.C.V.S., a son, Nigel Weldon.

COMING EVENTS

June

8th (Wed.). A General Meeting of the South Wales Division at the Caswell Bay Hotel, Mumbles, Swansea, 2.15 p.m.

10th (Fri.). Annual Dinner of the R.A.V.C. Officer's Club at the Naval and Military Club, 94, Piccadilly, London, W.1.

Annual General Meeting of the Shropshire Veterinary Club at the Oak Hotel, Shelton, Shrewsbury, 8 p.m.

11th (Sat.). Annual Reunion Dinner of the R.V.C. 1952 Club at Ye Miller of Mansfield, Goring, 7 p.m.

15th (Wed.). Meeting of the B.S.A.V.A. Metropolitan Region at the Royal Society of Medicine, 1, Wimpole Street, London, W.1, 7 p.m.

16th (Thurs.). Meeting of the Sussex Veterinary Society at the Old Ship Hotel, Brighton, 8.30 p.m.

17th (Fri.). Summer Meeting of the Northern Ireland Veterinary Association at the Silverbirch Hotel, Gortin Road, Omagh, 7.15 p.m.

25th (Sat.). Meeting of the North West Region of the B.S.A.V.A. at the Conservative Club, Market Street, Wigan, 7.30 p.m.

29th (Wed.). Summer Meeting of the Scottish Metropolitan Division in the Green Hotel, Kinross, 2.45 p.m.

July

6th (Wed.). Meeting of the Technical Development Committee of the B.V.A., at 7, Mansfield Street, 10.30 a.m.

20th, 21st and 22nd (Wed., Thurs. and Fri.). B.V.A. Committee and Council Meetings in London.

August 28th to September 3rd. 78th Annual Congress of the British Veterinary Association in Glasgow.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Ayr. Ravenscroft Farm, Rankinston (May 24).

Leics. Penbury Farm, Stretton Road, Great Glen (May 30).

Fowl Pest

Hants. Elvetham Farm House, Elvetham, Hartley Wintney; 5, Bakers Bridge Cottage, Elvetham, Hartley Wintney (May 24).

Leics. Goldsmiths Grange, Thorpe Arnold, Melton Mowbray; 53, Dunton Road, Broughton Astley; Clavering, Kirby Bellars, Melton Mowbray (May 24); Barrow-on-Soar, Loughborough; 3, Mansion House, Brook Lane, Asfordby, Melton Mowbray; 10, Barkby Road, Syston (May 26); The Croft, Old Dalby, Melton Mowbray; 1207, Melton Road, Syston; Depdale Farm, Thorpe Arnold, Melton Mowbray; Premises adjoining 40, Victoria Street, Narborough; The Coppice, Queniborough (May 27); Fir Farm, Thurnby (May 28); Keyham Hall, Keyham (May 30).

Lincs. Woodbine Cottage, Sewstern, Grantham; The Garth, 45, Lincoln Road, Horncastle (May 24); Questers, Sudbrook Lane, Nettleham (May 29); Langham Farm, Legsby, Market Rasen (May 30).

Norfolk. 4A, Northfield Waye, Wells-next-the-Sea (May 24).

Notts. Bassingfield Lane, Gamston; The Smallholding, 14, Beacon Hill, Newark; Works Farm, Barnstone (May 24); House Farm, Edwinstowe, Mansfield; Acton Road Allotments, Long Eaton (May 26); Orchard House, Granby (May 27).

Oxford. 12, Valencia Close, Bletchington (May 26).

Warwicks. Mill Farm, Dunton Bassett, Rugby (May 24); Cathiron Farm, Harborough Magna, Rugby (May 26); Top Farm, Higham Lane, Nuneaton (May 27); Hall Farm, Ullesthorpe, Rugby (May 28).

Worcs. Leystile, Heightington, Bewdley; Richmond Cottage, Pound Green, Arley, Bewdley (May 24); Elfords, Heightington, Bewdley; Little Heath, Heightington, Bewdley; The Riddings, Heightintgon, Bewdley (May 26); Farmans Court, Heightington, Bewdley (May 28).

Swine Fever

Berks. The Bridges, Mortimer West End, Reading (May 30).

Denbigh. Llwyn Knottia, Rhosnessney, Wrexham (May 26); Emral Lodge, Worthenbury, Wrexham (May 27).

Essex. Kirby Hall Lane Piggeries, Castle Hedingham, Halstead (May 24).

Hunts. The Orchard, Wyton (May 27).

Lancs. 3, Dockey Pool Lane, off Highfield Road East, Marton Moss, Blackpool (May 26); Pauls Farm, 382, Dunkirk Lane, Leyland, Preston; Moss Farm, Leyland, Preston (May 30).

Norfolk. Lime Kiln Farm, Stoke Holy Cross, Norwich (May 24); Northacre Farm, Caston, Attleborough; Wroo Farm, Wroo Road, Attleborough (May 25); The Beeches, Dickleburgh, Diss (May 27).

Salop. Fields Farm, Agden, Whitchurch; Upper Hollicott, Bridgnorth (May 24); Broadway, Little Hereford, Ludlow; Brook Farm, Linford Weston, Shrewsbury (May 27); Bank

Farm, Wrockwardine, Wellington; Bowens Hall, Hanmer, Whitchurch (May 30).

Somerset. Piggeries, Dykes Farm, Stowell, Templecombe; Milton Farm, Milton Clevedon, Evercreech (May 26); Toomer Farm, Henstridge; Pool Farm, South Road, Taunton (May 30).

Suffolk. Bridge Farm, Bramfield, Halesworth (May 26); Elms Estate Allotments, Blackheath Road, Lowestoft (May 30).

Sussex. Park Farm, Bosham, Chichester (May 30).

Yorks. Markenfield Hall, Ripon; The Grange, Rainton, Thirsk (May 30).

Letters to the Editor

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

Infertility in the Dog

Sir,—Just a note to tell you how much I enjoy reading THE VETERINARY RECORD. For the most part the articles in your journal are interesting, informative, and timely.

I should like to comment on a recent article, "An Aspect of Infertility in the Dog" by A. E. Harrop. In studying Table I, I note that in all cases the first microscopical examination of sperm showed "no sperms present." After observing this, I am wondering why Mr. Harrop attempted hormonal therapy.

In my work in the treatment of sterility or lack of aggressiveness in the male a sperm count should be made before instituting hormonal therapy. If the count should be found to be deficient or the presence of abnormal forms of spermatozoa are found, the use of PMS may be of considerable value. If, on the other hand, aspermia or a complete absence of spermatozoa exists, the value of PMS or any other hormonal substance is extremely doubtful. In fact, when aspermia exists, I have never been able to stimulate the formation of sperm cells.

In the male PMS increases the activity of the Leydig cells of the testes which in turn secrete larger amounts of testosterone, resulting in an enlargement of the seminal vesicles and prostate. In the treatment of functional impotence of the male PMS has been of considerable benefit, since its use usually results in an increased libido. In such cases a dosage of 200 to 500 I.U. of PMS should be used, according to the size of the dog; for instance, in a male Scottish Terrier I would use a dose of 200 I.U. This may be repeated at 3- to 6-day intervals, depending upon the clinical response, that is, increase in libido or sperm count.

Spermatogenesis is usually stimulated providing there is tissue present that is capable of being stimulated. Usually one or two injections followed by a sperm count in one week will inform one if there is a probability of response. If one is using a purified PMS preparation, it is best to administer it intravenously inasmuch as this introduces the hormone directly into the blood stream for greater effect since PMS is not eliminated by the kidneys.

I trust you will not feel that I am presumptive in sending my comments. For some years I have had a great respect for British medical and veterinary research.

Yours faithfully,
JACK L. DAVIDSON.

The Upjohn Company,
Kalamazoo,
Michigan, U.S.A.
May 24th, 1960.

Vaccination of Cattle with S.19

Sir,—There are one or two points I would like to make concerning the excellent symposium on brucellosis in last week's issue.

In Dr. McDiarmid's interesting paper he states that "a considerable amount of indiscriminate vaccination has been carried out in Oxfordshire." This is an implied criticism of the practitioners who do these vaccinations and I take exception to it.

Most of the main dairy breeds and some beef breeds have, since the war, maintained a strict set of rules concerning the blood testing and vaccination of cattle for contagious abortion. These will certainly have been drawn up with the best veterinary advice of the time and probably everyone will agree that this arrangement, together with the efficacy of the vaccine, has been most successful in controlling the disease in cattle. These rules, in short and in the main, state that a female must be vaccinated in calfhood and thereafter at intervals of 2 pregnancies or under 3 years. Animals vaccinated outside this schedule (barring very young calves, of course) must first pass a blood test. Many non-pedigree herds followed this scheme, the vaccinations being done to cover 2 to 3 pregnancies.

Breed Societies have changed, or are changing, their rules to match our present knowledge, but they are understandably cautious in altering a a scheme that has been so reliable in the past. Flying herds of milking cattle are usually vaccinated at some time or other, particularly if an abortion or two occurs in elderly females showing high blood titres. This is surely better, from the animal health point of view, than no protection at all. What other practical course is there left to take?

The onus of advising a client on these various problems falls on the practitioner and him alone. His advice and action, whether right or wrong, cannot be described as "indiscriminate."

Dr. McDiarmid further states that in relation to the vaccination of adults "the farmers and their veterinary advisers were still unaware that one dose of S.19 in calfhood was, for all practical purposes, as effective as one or more in adult life."

The time that has elapsed since the indications from work published by Dr. McDiarmid in 1957 suggesting that one calfhood vaccination would give lifelong immunity, is about 3 years. Cattle born in that year, and after, could only have calved once and, in any case, would have been vaccinated once or not at all. Older cattle, whether pedigree or commercial, may have been vaccinated once since then according to their Society rules or a similar

scheme. I cannot, therefore, understand on what grounds he bases his criticism.

The practitioner could return the charge of being out of date by asking why and how it has taken 15 years or so for research workers to realise that *Brucella abortus* in the milk is causing such an apparently serious public health problem, in spite of the use of S.19? In this respect, and only in this respect, this vaccine is in the same class as the old living field strain and strain 45-20. This was one of the reasons why these vaccines were rejected so long ago.

Dr. Bothwell echoes in part Dr. McDiarmid's views, but his footnote concerning a suggestion of free supply of vaccine to farmers is interesting. The idea, apparently, was to ensure the fullest use of S.19, but it was rejected because "cost was not deemed an obstacle to vaccination." If this is the case, then there may be hope for our gallant B.V.A. Officers who have been fighting unsuccessfully for years to obtain an increase on the wretched minimum figure of 1s. 4d. per head per animal vaccinated under the scheme.

During 1958 a client of ours in Oxfordshire had the misfortune to have some cows excreting *Br. abortus* in the milk. This state of affairs was picked up and traced back by the authorities in a most commendable manner. Their handling of the yeoman farmer, on the other hand, was in my opinion tactless and inexperienced. The farmer at first was not sure what his trouble was and it took me quite a time to find out. At least 4 different departments were concerned with the affair (not including Animal Health who would have handled the matter far more expertly) and the poor fellow was replying to one department with letters meant for another. In addition, the liaison between some of these departments was bad, as was admitted during subsequent correspondence. There was no direct notice to the veterinary surgeon concerned as to what was going on and I was informed that the regulations did not permit this. After requesting some official information (as opposed to the doubtful information of the farmer), I got it.

We wallowed in this dreary Sargasso of bureaucracy not knowing if we were in our gluteals or our olecronon processes, until the M.o.H. Dept. conceded that, owing to my interest in this case, they would keep me informed of future cases, provided the farmer gave them permission first.

The work that Dr. McDiarmid and his colleagues have done concerning contagious abortion in cattle will probably never be forgotten and there is plenty of scope yet for his talents, as this incident shows.

In my view, it is not worthy of the learned Doctor to criticise his practising colleagues in the way he has done, and it is time he appreciated that many of these gentlemen have also contributed, in a much less distinguished way, to the control of this disease.

Yours faithfully,
A. K. KIRKWOOD.

14, Queen's Road,
Reading.
May 30th, 1960.

R.C.V.S. Council Elections

Sir,—I should be most grateful if you would allow me the opportunity to thank those colleagues whose support elected me to the Council of the Royal College of Veterinary Surgeons. It will be my constant aim and endeavour to justify that generous support to the best of my ability.

Yours faithfully,
J. McCONNACHIE INGRAM.

Three Ways,
Limpsfield,
Oxted, Surrey.
May 30th, 1960.

Sir,—May I, through the courtesy of your columns, thank those colleagues in the profession whose votes conferred on me the honour of election to the Council of the Royal College of Veterinary Surgeons. I shall spare no endeavour to justify their confidence.

Yours faithfuly,
J. HICKMAN.

Department of Veterinary Clinical Studies.
Madingley Road,
Cambridge.
May 28th, 1960.

Sir,—May I take this opportunity through the courtesy of your columns of thanking all those who kindly voted in my favour during the recent R.C.V.S. elections.

Yours faithfully,
ALASDAIR STEELE-BODGER.

10, Bore Street,
May 28th, 1960.
Lichfield. Staffs.

We are asked to say that Mr. Harry M. Wilson thanks all those who supported him in the recent elections.

DISEASES OF ANIMALS ACT, 1950—GREAT BRITAIN
Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period		Anthrax	Atrophic Rhinitis	Foot-and-Mouth	Fowl Pest	Sheep Scab	Swine Fever
1st to 15th April, 1960		11	—	—	104	—	33
Corresponding period in	1959	20	—	—	42	—	49
	1958	3	1	8	28	—	43
	1957	31	—	—	18	—	29
1st Jan. to 15th April, 1960		90	—	10	986	—	318
Corresponding period in	1959	83	—	1	260	—	337
	1958	55	3	108	223	—	311
	1957	164	2	15	269	—	242